

1. (Previously Presented) A computer-implemented method for querying a structured document, comprising:

identifying auxiliary structures including pre-computed information applicable to accelerate user query processing by detecting containment mappings between query expressions and expressions in the auxiliary structures,

wherein the auxiliary structures include a number of indexes, a number of partial XML indexes, and a number of materialized views;

computing compensation to perform index selection and materialized view matching to determine what portion of said query expressions are evaluated by said index and said materialized view;

finding the user query result by executing a rewritten query that exploits the pre-computed information to each detected containment mapping; and

reporting said user query result to said user,

wherein executing the rewritten query further comprises:

constructing a pushdown expression for to perform evaluation with information in the auxiliary structure; and

constructing a compensation expression for to perform evaluation as a residual query, wherein said residual query comprises at least a portion of said query not associated with said index or said materialized view.

2. (Currently Amended) The method of claim 1, all the limitations of which are incorporated herein by reference, further comprising implementing the method in a relational database management system.
3. (Currently Amended) The method of claim 1, all the limitations of which are incorporated herein by reference, wherein the structured document includes a set of nodes described by an expression tree.
4. (Currently Amended) The method of claim 1, all the limitations of which are incorporated herein by reference, wherein the structured document is an XML document.
5. (Cancelled).
6. (Currently Amended) The method of claim 1, all the limitations of which are incorporated herein by reference, wherein the pre-computed information includes precomputed XPath results (PXR's).
7. (Currently Amended) The method of claim 1, all the limitations of which are incorporated herein by reference, wherein the user query processing further comprises navigating path expressions with a query language.

8. (Currently Amended) The method of claim 7, all the limitations of which are incorporated herein by reference, wherein the query language employs XPath.

9. (Currently Amended) The method of claim 7, all the limitations of which are incorporated herein by reference, wherein the query language includes at least one of: XQuery, SQL/XML, and XSLT.

10. (Currently Amended) The method of claim 1, all the limitations of which are incorporated herein by reference, wherein the detecting further comprises:

selectively executing a set of predetermined sequential rules to perform traversing of a tree of nodes; matching node data with the pre-computed information; and selecting auxiliary structures that subsume portions of the user query.

11. (Previously Presented) A computer-implemented method for querying a structured document, comprising:

identifying auxiliary structures including pre-computed information applicable to accelerate user query processing by detecting containment mappings between query expressions and expressions in the auxiliary structures,

wherein the auxiliary structures include a number of indexes, a number of partial XML indexes, and a number of materialized views;

computing compensation to perform index selection and materialized view matching to determine what portion of said query expressions are evaluated by said index and said materialized view;

finding the user query result by executing a rewritten query that exploits the pre-computed information to each detected containment mapping; and

reporting said user query result to said user;

wherein the detecting further comprises:

selectively executing a set of predetermined sequential rules to perform traversing of a tree of nodes; matching node data with the pre-computed information; and

selecting auxiliary structures that subsume portions of the user query,

wherein the node data includes axis data, test data, predicate data, and next step node data.

12. (Previously Presented) A computer-implemented method for querying a structured document, comprising:

identifying auxiliary structures including pre-computed information applicable to accelerate user query processing by detecting containment mappings between query expressions and expressions in the auxiliary structures,

wherein the auxiliary structures include a number of indexes, a number of partial XML indexes, and a number of materialized views;

computing compensation to perform index selection and materialized view matching to determine what portion of said query expressions are evaluated by said index and said materialized view;

finding the user query result by executing a rewritten query that exploits the pre-computed information to each detected containment mapping;

reporting said user query result to said user; and

normalizing expression trees by moving predicate conditions into filter expressions before the identifying,

wherein the detecting further comprises:

selectively executing a set of predetermined sequential rules to perform traversing of a tree of nodes; matching node data with the pre-computed information; and selecting auxiliary structures that subsume portions of the user query.

13. (Cancelled).

14. (Currently Amended) The method of claim 1, all the limitations of which are incorporated herein by reference, wherein the compensation expression is an XPath predicate.

15. (Currently Amended) The method of claim 1, all the limitations of which are incorporated herein by reference, further comprising building a taxonomy of auxiliary structures.

16. (Currently Amended) The method of claim 15, all the limitations of which are incorporated herein by reference, further comprising classifying compensation expressions to the taxonomy according to a predetermined set of values.

17. (Currently Amended) The method of claim 1, all the limitations of which are incorporated herein by reference, wherein the identifying handles at least one of: nested path expressions, nested predicates, value-based comparison predicates, conjunction, disjunction, all XPath axes, branches, and wild cards.

18. (Currently Amended) The method of claim 17, all the limitations of which are incorporated herein by reference, wherein the XPath axes include child, descendant, self, attribute, parent, and descendant-or-self.

19. (Currently Amended) The method of claim 1, all the limitations of which are incorporated herein by reference, further comprising creating a mapping directed acyclic graph (DAG) that separately encodes a set of all containment mappings for each node.

20. (Previously Amended) A computer-implemented method for querying a structured document, comprising:

identifying auxiliary structures including pre-computed information applicable to accelerate user query processing by detecting containment mappings between query expressions and expressions in the auxiliary structures,

wherein the auxiliary structures include a number of indexes, a number of partial XML indexes, and a number of materialized views;

computing compensation to perform index selection and materialized view matching to determine what portion of said query expressions are evaluated by said index and said materialized view;

finding the user query result by executing a rewritten query that exploits the pre-computed information to each detected containment mapping; and  
reporting said user query result to said user;

further comprising creating a mapping directed acyclic graph (DAG) that separately encodes a set of all containment mappings for each node,

wherein creating the mapping DAG is polynomial in terms of a size of expression trees.

21. (Currently Amended) The method of claim 19, all the limitations of which are incorporated herein by reference, further comprising pruning the mapping DAG to remove invalid node pairs.

22. (Previously Presented) A computer-based system for querying a structured document, comprising:

an identifier of auxiliary structures including pre-computed information applicable to accelerate user query processing by detecting containment mappings between query expressions and expressions in the auxiliary structures,

wherein the auxiliary structures include a number of indexes, a number of partial XML indexes, and a number of materialized views;

a computer that computes computing compensation to perform index selection and materialized view matching to determine what portion of said query expressions are evaluated by said index and said materialized view; and

a query evaluator that finds the user query result by executing a rewritten query that exploits the pre-computed information to each detected containment mapping, wherein said query evaluator reports said user query result to said user,

wherein executing the rewritten query further comprises:

constructing a pushdown expression for to perform evaluation with information in the auxiliary structure; and

constructing a compensation expression for to perform evaluation as a residual query,

wherein said residual query comprises at least a portion of said query not associated with said index or said materialized view.



23. (Currently Amended) The system of claim 22, all the limitations of which are incorporated herein by reference, that is implemented in a relational database management system.

24. (Currently Amended) The system of claim 22, all the limitations of which are incorporated herein by reference, wherein the structured document includes a set of nodes described by an expression tree.

25. (Currently Amended) The system of claim 22, all the limitations of which are incorporated herein by reference, wherein the structured document is an XML document.

26. (Cancelled).

27. (Currently Amended) The system of claim 22, all the limitations of which are incorporated herein by reference, wherein the pre-computed information includes precomputed XPath results (PXR).

28. (Currently Amended) The system of claim 22, all the limitations of which are incorporated herein by reference, wherein the user query processing employs a query language that navigates path expressions.

29. (Currently Amended) The system of claim 28, all the limitations of which are incorporated herein by reference, wherein the query language employs XPath.

30. (Currently Amended) The system of claim 28, all the limitations of which are incorporated herein by reference, wherein the query language includes at least one of: XQuery, SQL/XML, and XSLT.

31. (Currently Amended) The system of claim 22, all the limitations of which are incorporated herein by reference, wherein the identifier:

selectively executes a set of predetermined sequential rules to perform traversing of a tree of nodes; matches node data with the pre-computed information; and  
selects auxiliary structures that subsume portions of the user query.

32. (Previously Presented) A computer-based system for querying a structured document, comprising:

an identifier of auxiliary structures including pre-computed information applicable to accelerate user query processing by detecting containment mappings between query expressions and expressions in the auxiliary structures,

wherein the auxiliary structures include a number of indexes, a number of partial XML indexes, and a number of materialized views;

a computer that computes computing compensation to perform index selection and materialized view matching to determine what portion of said query expressions are evaluated by said index and said materialized view; and

a query evaluator that finds the user query result by executing a rewritten query that exploits the pre-computed information to each detected containment mapping, wherein said query evaluator reports said user query result to said user,

wherein the identifier:

selectively executes a set of predetermined sequential rules to perform traversing of a tree of nodes; matches node data with the pre-computed information; and selects auxiliary structures that subsume portions of the user query,

wherein the node data includes axis data, test data, predicate data, and next step node data.

33. (Previously Presented) A computer-based system for querying a structured document, comprising:

an identifier of auxiliary structures including pre-computed information applicable to accelerate user query processing by detecting containment mappings between query expressions and expressions in the auxiliary structures,

wherein the auxiliary structures include a number of indexes, a number of partial XML indexes, and a number of materialized views;

a computer that computes computing compensation to perform index selection and

materialized view matching to determine what portion of said query expressions are evaluated by said index and said materialized view; and

a query evaluator that finds the user query result by executing a rewritten query that exploits the pre-computed information to each detected containment mapping, wherein said query evaluator reports said user query result to said user,

wherein the identifier:

selectively executes a set of predetermined sequential rules to perform traversing of a tree of nodes; matches node data with the pre-computed information; and selects auxiliary structures that subsume portions of the user query,

wherein the identifier normalizes expression trees by moving predicate conditions into filter expressions before the identifier begins detecting.

34. (Cancelled).

35. (Currently Amended) The system of claim 22, all the limitations of which are incorporated herein by reference, wherein the compensation expression is an XPath predicate.

36. (Currently Amended) The system of claim 22, all the limitations of which are incorporated herein by reference, wherein the identifier builds a taxonomy of auxiliary structures.

37. (Currently Amended) The system of claim 36, all the limitations of which are incorporated herein by reference, wherein the identifier classifies compensation expressions to the taxonomy according to a predetermined set of values.

38. (Currently Amended) The system of claim 22, all the limitations of which are incorporated herein by reference, wherein the identifier handles at least one of: nested path expressions, nested predicates, value-based comparison predicates, conjunction, disjunction, all XPath axes, branches, and wild cards.

39. (Currently Amended) The system of claim 38, all the limitations of which are incorporated herein by reference, wherein the XPath axes include child, descendant, self, attribute, parent, and descendant-or-self.

40. (Currently Amended) The system of claim 22, all the limitations of which are incorporated herein by reference, wherein the identifier creates a mapping directed acyclic graph (DAG) that separately encodes a set of all containment mappings for each node.

41. (Previously Presented) A computer-based system for querying a structured document, comprising:

an identifier of auxiliary structures including pre-computed information applicable to accelerate user query processing by detecting containment mappings between query expressions

and expressions in the auxiliary structures,

wherein the auxiliary structures include a number of indexes, a number of partial XML indexes, and a number of materialized views;

a computer that computes computing compensation to perform index selection and materialized view matching to determine what portion of said query expressions are evaluated by said index and said materialized view; and

a query evaluator that finds the user query result by executing a rewritten query that exploits the pre-computed information to each detected containment mapping, wherein said query evaluator reports said user query result to said user,

wherein the identifier creates a mapping directed acyclic graph (DAG) that separately encodes a set of all containment mappings for each node, and

wherein creating the mapping DAG is polynomial in terms of a size of expression trees.

42. (Currently Amended) The system of claim 40, all the limitations of which are incorporated herein by reference, wherein the identifier prunes the mapping DAG to remove invalid node pairs.

43. (Previously Presented) A computer program product stored on a computer readable device tangibly embodying a program of computer-executable instructions to perform a method for querying a structured document, the method comprising:

identifying auxiliary structures including pre-computed information applicable to

accelerate user query processing by detecting containment mappings between query expressions and expressions in the auxiliary structures,

wherein the auxiliary structures include a number of indexes, a number of partial XML indexes, and a number of materialized views;

computing compensation to perform index selection and materialized view matching to determine what portion of said query expressions are evaluated by said index and said materialized view;

finding the user query result by executing a rewritten query that exploits the precomputed information to each detected containment mapping; and

reporting said user query result to said user,

wherein said detecting of said containment mappings between said query expressions and said expressions in said auxiliary structures comprises matching node data of said query expressions with XPath expressions of said index and said materialized view, wherein said node data comprises axis data, test data, predicate data, and next XPath step node data.

44. (Currently Amended) The computer program product of claim 43, all the limitations of which are incorporated herein by reference, further comprising implementing the method in a relational database management system.

45. (Currently Amended) The computer program product of claim 43, all the limitations of which are incorporated herein by reference, wherein the structured document includes a set of nodes described by an expression tree.

46. (Currently Amended) The computer program product of claim 43, all the limitations of which are incorporated herein by reference, wherein the structured document is an XML document.

47. (Cancelled).

48. (Currently Amended) The computer program product of claim 43, all the limitations of which are incorporated herein by reference, wherein the pre-computed information includes pre-computed XPath results (PXR).

49. (Currently Amended) The computer program product of claim 43, all the limitations of which are incorporated herein by reference, wherein the user query processing further comprises navigating path expressions with a query language.

50. (Currently Amended) The computer program product of claim 49, all the limitations of which are incorporated herein by reference, wherein the query, language employs XPath.



51. (Currently Amended) The computer program product of claim 49, all the limitations of which are incorporated herein by reference, wherein the query language includes at least one of: XQuery, SQL/XML, and XSLT.

52. (Currently Amended) The computer program product of claim 43, all the limitations of which are incorporated herein by reference, wherein the detecting further comprises:

selectively executing a set of predetermined sequential rules to perform traversing of a tree of nodes;

matching node data with the pre-computed information; and

selecting auxiliary structures that subsume portions of the user query.

53. (Currently Amended) The computer program product of claim 52, all the limitations of which are incorporated herein by reference, wherein the node data includes axis data, test data, predicate data, and next step node data.

54. (Currently Amended) The computer program product of claim 52, all the limitations of which are incorporated herein by reference, further comprising normalizing expression trees by moving predicate conditions into filter expressions before the identifying.

55. (Currently Amended) The computer program product of claim 43, all the limitations of which are incorporated herein by reference, wherein executing the

rewritten query further comprises:

constructing a pushdown expression to perform evaluation with information in the auxiliary structure; and

constructing a compensation expression to perform evaluation as a residual query, wherein said residual query comprises at least a portion of said query not associated with said index or said materialized view.

56. (Currently Amended) The computer program product of claim 55, all the limitations of which are incorporated herein by reference, wherein the compensation expression is an XPath predicate.

57. (Currently Amended) The computer program product of claim 55, all the limitations of which are incorporated herein by reference, further comprising building a taxonomy of auxiliary structures.

58. (Currently Amended) The computer program product of claim 57, all the limitations of which are incorporated herein by reference, further comprising classifying compensation expressions to the taxonomy according to a predetermined set of values.

59. (Currently Amended) The computer program product of claim 43, all the limitations of which are incorporated herein by reference, wherein the identifying handles at least one of:

nested path expressions, nested predicates, value-based comparison predicates, conjunction, disjunction, all XPath axes, branches, and wild cards.

60. (Currently Amended) The computer program product of claim 59, all the limitations of which are incorporated herein by reference, wherein the XPath axes include child, descendant, self, attribute, parent, and descendant-or-self.

61. (Currently Amended) The computer program product of claim 43, all the limitations of which are incorporated herein by reference, further comprising creating a mapping directed acyclic graph (DAG) that separately encodes a set of all Containment mappings for each node.

62. (Currently Amended) The computer program product of claim 61, all the limitations of which are incorporated herein by reference, wherein creating the mapping DAG is polynomial in terms of a size of expression trees.

63. (Currently Amended) The computer program product of claim 61, all the limitations of which are incorporated herein by reference, further comprising pruning the mapping DAG to remove invalid node pairs.

64. (Cancelled).

65. (Previously Presented) A computer-implemented method for querying a structured document, comprising:

identifying auxiliary structures including pre-computed information applicable to accelerate user query processing by detecting containment mappings between query expressions and expressions in the auxiliary structures,

wherein the auxiliary structures include a number of indexes, a number of partial XML indexes, and a number of materialized views;

computing compensation to perform index selection and materialized view matching to determine what portion of said query expressions are evaluated by said index and said materialized view;

finding the user query result by executing a rewritten query that exploits the pre-computed information to each detected containment mapping; and  
reporting said user query result to said user,

wherein said detecting of said containment mappings between said query expressions and said expressions in said auxiliary structures comprises matching node data of said query expressions with XPath expressions of said index and said materialized view, wherein said node data comprises axis data, test data, predicate data, and next XPath step node data.

66. (Previously Presented) A computer-based system for querying a structured document, comprising:

an identifier of auxiliary structures including pre-computed information applicable to

accelerate user query processing by detecting containment mappings between query expressions and expressions in the auxiliary structures,

wherein the auxiliary structures include a number of indexes, a number of partial XML indexes, and a number of materialized views;

a computer that computes computing compensation to perform index selection and materialized view matching to determine what portion of said query expressions are evaluated by said index and said materialized view; and

a query evaluator that finds the user query result by executing a rewritten query that exploits the pre-computed information to each detected containment mapping, wherein said query evaluator reports said user query result to said user,

wherein said detecting of said containment mappings between said query expressions and said expressions in said auxiliary structures comprises matching node data of said query expressions with XPath expressions of said index and said materialized view, wherein said node data comprises axis data, test data, predicate data, and next XPath step node data.

67. (Cancelled).